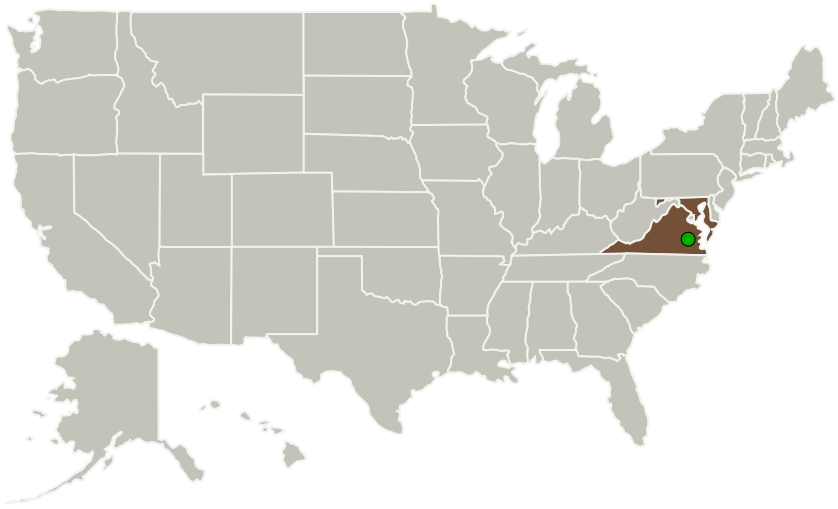
A Modular Swarm Optimization Framework Enabling Multi-Vehicle Coordinated Path Planning, Phase II

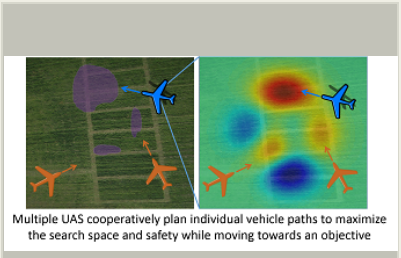
Completed Technology Project (2016 - 2018)

Project Introduction

The advancement of Unmanned Aerial Systems (UAS) with computing power and communications hardware has enabled an increased capability set for multi-vehicle collaborative operations. By cooperatively allocating unmanned resources, vehicle tasking, and planning the subsequent vehicle paths, the efficiency of UAS operations can be maximized. Heron Systems proposes to develop the Multi-Agent Cooperative Engagement (MACE) framework into a mature prototype that enables collaborative resource allocation, task allocation, and path planning for unmanned systems operating in dynamic environments subject to diverse communication conditions. This Phase 2 work will focus on refining the path planning portion of MACE as well as maturing the resource and task allocation library developed during Phase 1. The path planning architecture will define key modules to plan paths to a global objective, assess potential obstacles, and avoid collisions while maintaining progress towards the global objective. The framework will be constructed in a modular fashion to allow a plug-and-play capability for the resource/task allocation as well as the various components of the path planning pipeline, giving end users the flexibility to explore other methods for UAS collaboration. At the conclusion of Phase 2, the MACE framework will be demonstrated using Heron Systems— HWIL simulation/stimulation environment. Once verified via the HWIL environment, the MACE framework will be deployed onboard several aerial assets and tested against scenarios specifically tailored towards precision agriculture applications.

Primary U.S. Work Locations and Key Partners





Multiple UAS cooperatively plan individual vehicle paths to maximize the search space and safety while moving towards an objective

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Organizations Performing Work	Role	Type	Location
Heron Systems, Inc.	Lead Organization	Industry Small Disadvantaged Business (SDB)	California, Maryland
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Maryland	Virginia

Project Transitions

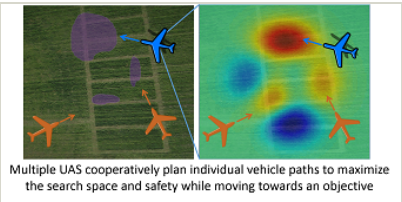
May 2016: Project Start

June 2018: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139592)*

Images



Briefing Chart Image
A Modular Swarm Optimization Framework Enabling Multi-Vehicle Coordinated Path Planning, Phase II *(https://techport.nasa.gov/image/128677)*

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Heron Systems, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

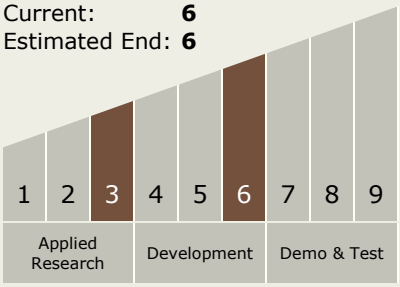
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Kenneth Kroeger

Technology Maturity (TRL)

Start: **3**
Current: **6**
Estimated End: **6**



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Technology Areas

Primary:

- TX11 Software, Modeling, Simulation, and Information Processing
  - TX11.3 Simulation
    - TX11.3.4 Simulation-Based Training and Decision Support Systems

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System